



MIT SCALE RESEARCH REPORT

The MIT Global Supply Chain and Logistics Excellence (SCALE) Network is an international alliance of leading-edge research and education centers, dedicated to the development and dissemination of global innovation in supply chain and logistics.

The Global SCALE Network allows faculty, researchers, students, and affiliated companies from all six centers around the world to pool their expertise and collaborate on projects that will create supply chain and logistics innovations with global applications.

This reprint is intended to communicate research results of innovative supply chain research completed by faculty, researchers, and students of the Global SCALE Network, thereby contributing to the greater public knowledge about supply chains.

For more information, contact
MIT Global SCALE Network

Postal Address:
Massachusetts Institute of Technology 77
Massachusetts Avenue, Cambridge, MA 02139 (USA)

Location:
Building E40, Room 267
1 Amherst St.

Access:
Tel: +1 617-253-5320
Fax: +1 617-253-4560

Email: scale@mit.edu
Website: scale.mit.edu

Research Report: ZLC-2012-6
Supply Chain and Logistics Security
Andrés Vadillo González and Maria Ioanna Levanti

For Full Thesis Version Please Contact:

Marta Romero

ZLOG Director

Zaragoza Logistics Center (ZLC) Edificio

Náyade 5, C/Bari 55 – PLAZA 50197

Zaragoza, SPAIN

Email: mromero@zlc.edu.es

Telephone: +34 976 077 605

Supply Chain and Logistics Security

By Andrés Vadillo González and Maria Ioanna Levanti
Thesis Advisor: Dr. Mustafa Çağrı Gürbüz

Summary: This thesis investigates and analyzes the supply chain and logistics security in a global pharmaceutical company. Particularly we investigate the risk of theft in transit and in storage. We identify relevant risks after the goods have left the firm's direct control and we also design a model to estimate the risk exposure of goods, and the right measures to be taken in order to mitigate such risks.



M.E in Logistics and Supply Chain Management, MIT-Zaragoza International Logistics Program, Spain

Industrial Engineer, Universidad de Zaragoza, Spain



M.E in Logistics and Supply Chain Management, MIT-Zaragoza International Logistics Program, Spain

BSc in Maritime Studies, University of Piraeus, Greece

KEY INSIGHTS

1. Pharmaceutical goods in transit are exposed to theft risk, with dramatic consequences given their value and criticality for human lives.
2. The classic approach of measuring risk as a combination of “likelihood” and “consequences” can be substituted by “route” risk and “load” risk.
3. The combination of “route” and “load” risk will determine the mitigation strategies and measures to be implemented.

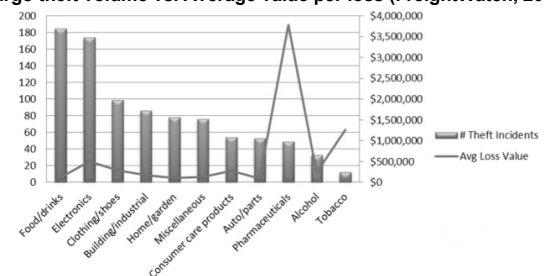
Introduction

Crime and Terrorism trends worldwide have increased the risk of global Supply Chains, requiring a closer look at security aspects. Especially, cargo theft rates have grown over the past years, and firms see this growing threat as a risk to their operations, bringing up the need for a high level of security throughout the whole supply chain.

According to FreightWatch (2011), the top three key drivers for cargo theft are (a) the increased value of shipments; (b) cargo theft is a low-risk, high-reward

crime; and (c) economic conditions. In addition, pharmaceutical products have a high value-to-size ratio (see graph below) and are easy to transport and sell, making them more attractive for criminal organizations. Finally, the fact that supply flow in the pharmaceutical industry is pivotal for patient care raised awareness on the need for end-to-end risk mitigation strategies to ensure a proper supply of medicines to the patients.

Cargo theft volume vs. Average value per loss (FreightWatch, 2011)



Diverse authors highlight the significance of heightened security and the challenges managers have to face, such as managing under uncertainty in a collaboration framework. Sheffi (2001) suggests good management practices, along with increased collaboration between the private and public sector, as security solutions. Urciuoli (2011) also brings to light the importance of enhanced real time visibility

and compliance with regulations as measures to address these risks. He also develops a Quantitative Risk Assessment approach aiming at quantifying costs and benefits, in form of risk reductions, of different security solutions against theft.

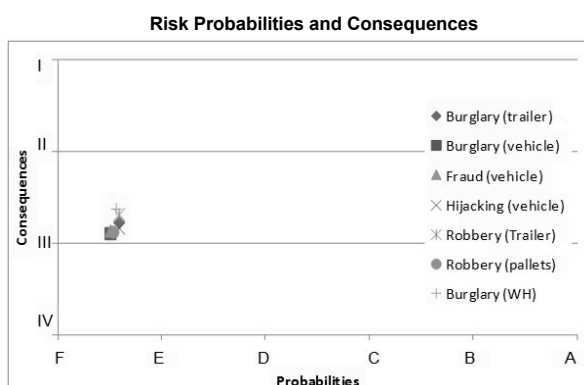
There are also specific programs that focus on the security of the physical flow of goods. Examples are the Transported Asset Protection Association (TAPA), the Authorised Economic Operator (AEO), the Customs Trade Partnership Against Terrorism (C-TPAT), FreightWatch and the International Organization for Standardization (ISO).

In this work, we collect the opinion of logistics experts to research what the main aspects of security related risks are. Then, we elaborate a risk assessment model based on route and load risks. Finally, we investigate and analyze different mitigation measures within the industry. Our study complements the current literature by offering a qualitative framework to assess cargo theft risk for the pharmaceutical industry. Our approach aims to identify the factors that drive theft risk within two dimensions: the inherent risk to a route; and the risk related to the load. We group the mitigation strategies into categories and we compare their suitability to different situations.

Data collection and analysis

Literature review and interviews were used to gather data regarding the aspects of the security in the pharmaceutical industry. We developed a questionnaire that was filled out by logistics managers. The main objective of this questionnaire was to evaluate the impact of different security-related hazards in the industry, as well as to identify different types of cargo theft and measures used to combat such cargo theft.

In total we received and analyzed answers to the questionnaires from 41 different countries, which in general identified cargo theft hazards as low probability and high consequence events, as can be seen in the graph below.



The main results are that Latin America is the most dangerous region and robbery of trailers is the most frequent event, while burglary, hijacking and similar types of theft are also common.

According to the managers, reduction/avoidance of stops and change of routes, avoiding specific locations, together with continuous monitoring of vehicles are the most popular actions. Some other measures to prevent theft are enhanced risk management procedures, training, or specific agreements with subcontractors and authorities (including security forces).

Overall, the answers gave us a good insight into identifying the risks that are relevant to cargo theft, as well as understanding which the appropriate measures to mitigate these risks are. Unfortunately, there was not enough information to do a cost-benefit analysis of the different measures, as such, we moved towards developing a more qualitative model to assess risk.

Global Risk Assessment Model

The Global Risk Assessment Model is designed to evaluate the risk level and trigger an action if necessary. We develop risk matrixes with discrete lane risk and load risk levels that can be used to identify when to implement different mitigation measures.

The main objectives of the model are to be a global tool that can be used by different sites, to be a fair representation of the risks faced by the company, to find improvement opportunities, and to keep track of them, while keeping simplicity of usage.

The lane risk factors reflect the risk inherent to a route, through historical cargo theft at origin and destination, and lane distance. It also considers the possibility of doing joint efforts with other companies to reduce risk (frequency of use of the lane), and the security measures offered by the carrier operating the route (carrier security).

The load risk factors include the value of the shipment (as COGS, which indirectly reflects additional costs), the patient safety risk (taking into consideration the criticality of life-saving and cold-chain drugs), and the supply risk (based on Lead Time and Pipeline Inventory).

Once the two risk scores are computed they are located in a matrix that, together with a study of mitigation measures, shows the type of actions to be taken.

| Mitigation strategies | | | |
|-----------------------|--------|--|--|
| Lane risk | "High" | Reduce lane risk: Alternative routes, track and trace devices. | Exceptions. Extreme security, including armed escorts. |
| | "Low" | Regular security procedures, inspections and training. | Reduce the consequences: split shipments, use escorts. |
| | | "Low" | "High" |
| Load risk | | | |

In order to keep track of the improvements, we recommend to document all the information related to implementation of measures and to measure three KPIs, reflecting Potential risk, Realized risk and Security performance.

Analysis of measures

We investigate different security improvements and measures: from new technology to improvements in processes and organizational aspects. We analyze their costs and benefits in a qualitative way in order to make appropriate recommendations.

There are basic measures to be widely implemented within the company transportation system. This category includes proactive reports, locked trucks, sealed containers, alarms, auto shut-off engines, and checklists, among others. We investigate some organizational measures that do not affect the shipments directly, but rather the people and the organization itself. The actions mentioned are specific training, contracts and agreements with third parties for enhanced security, relationships with the authorities.

In addition, there are track and trace measures to monitor the goods in transit and quickly react if something goes wrong. The measures considered are RFID tags, GPS and satellite phones. Alternative routing, teams of drivers to minimize the stops and time the goods are left unattended, or smaller shipments to reduce the maximum value of goods in the same vehicle are some of the routing measures analyzed. Sending an escort along with the shipment can be a good option to protect the goods. We compare several types, from unarmed escort only for dissuasive purposes, to armed escort, or even police/military involvement in key shipments.

Another way to mitigate risk are scanning measures from X-ray to physical inspection, including weighting and/or counting the goods at different stages.

For the warehouse security, most measures fall into the "basic measures" category (fencing, locks on gates, etc.). Finally, complying with initiatives such as

C-TPAT and AEO are measures that can reduce theft loss.

Conclusion

The objective of this work is to help our sponsor company in order for them to be able to assess their cargo theft risk, and apply appropriate measures to mitigate this risk. As it is extremely difficult to quantify either the likelihood or the consequence of theft events, we opted to develop a qualitative model, which substitutes the "probabilities" and "consequences" terms, by "lane" and "load" risks, these based on several factors affecting the risk.

We performed extensive research to find out what options are available for companies to protect their assets against theft, and our recommendation goes in the direction of following the main trends in the industry, which are:

Enhanced visibility: RFID tags and GPS devices are becoming very popular, as they allow finding the goods if they are stolen, and to continuously monitor the routes to quickly react to unexpected events.

Collaboration: There are many associations that help companies collaborate in security-related topics, by sharing data among the members, and providing guidance and best practices to improve logistics security.

Certifications: Different certifications in logistics security are becoming widely accepted and companies should ensure that their logistics providers are in compliance with them. They usually provide with recommendations on security measures.

Finally, there are some measures that can help minimize the loss, varying from limiting the maximum value loaded in a single shipment, to having different routes for a single delivery, or escorting important shipments. Global guidelines should be defined, so that the final decision of taking or not such measures can be made consistently.

Cited Sources

- FreightWatch. (2011). FreightWatch Annual Supply Chain Survey.
- Sheffi, Y. (2001). Supply Chain Management under the Threat of International Terrorism. The international Journal of Logistics Management, 12(2), 1-11.
- Urciuoli, L. (2011). Investing on Transport Security Solutions: using the Quantitative Risk Assessment (QRA) approach. International Journal of Risk Assessment and Management, 15(4), 275-298.